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Nanogap-Rich Au Nanowire SERS Sensor for Ultrasensitive Telomerase Activity Detection: Application to Gastric and Breast Cancer Tissue Diagnosis

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Abstract

Telomerase has attracted much attention as a universal cancer biomarker because telomerase is overexpressed in more than 85% of human cancer cells while suppressed in normal somatic cells. Since a strong association exists between telomerase activity and human cancers, the development of effective telomerase activity assay is critically important. Here, a nanogap-rich Au nanowire (NW) surface-enhanced Raman scattering (SERS) sensor is reported for detection of telomerase activity in various cancer cells and tissues. The nanogap-rich Au NWs are constructed by deposition of nanoparticles on single-crystalline Au NWs and provided highly reproducible SERS spectra. The telomeric substrate (TS) primer-attached nanogap-rich Au NWs can detect telomerase activity through SERS measurement after the elongation of TS primers, folding into G-quadruplex structures, and intercalation of methylene blue. This sensor enables us to detect telomerase activity from various cancer cell lines with a detection limit of 0.2 cancer cells mL^{-1}.

Importantly, the nanogap-rich Au NW sensor can diagnose gastric and breast cancer tissues accurately. The nanogap-rich Au NW sensors show strong SERS signals only in the presence of tumor tissues excised from 16 tumor-bearing mice, while negligible signals in the presence of heated tumor tissues or normal tissues. It is anticipated that nanogap-rich Au NW SERS sensors can be used for a universal cancer diagnosis and further biomedical applications including a diverse biomarker sensing.

논문정보

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